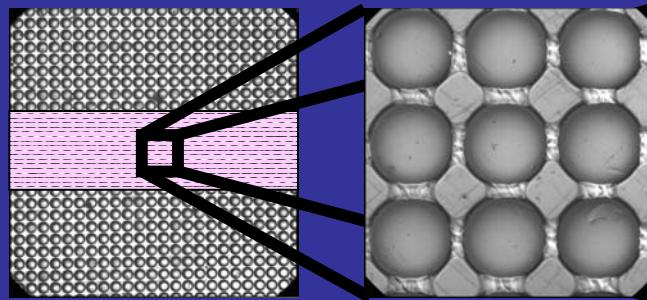




Combinatorial Adhesion Test Examples & Discussion



Christopher M. Stafford, Aaron Forster,
Alamgir Karim, Eric J. Amis



Case Studies



Macrolens

PDMS macrolens on:

- glass
- emulsion coating
- PDMS
- epoxy

Microlens Array

PDMS microlens array:

- dynamics vs. surface energy
- “jump into contact”

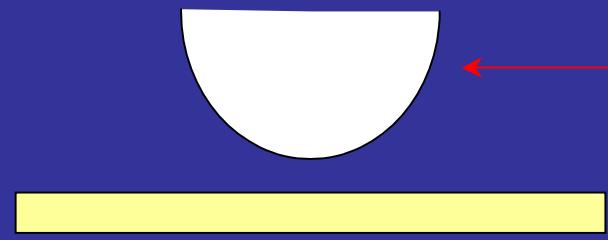
Epoxy microlens array on PSA



Glass/PDMS Macrolens

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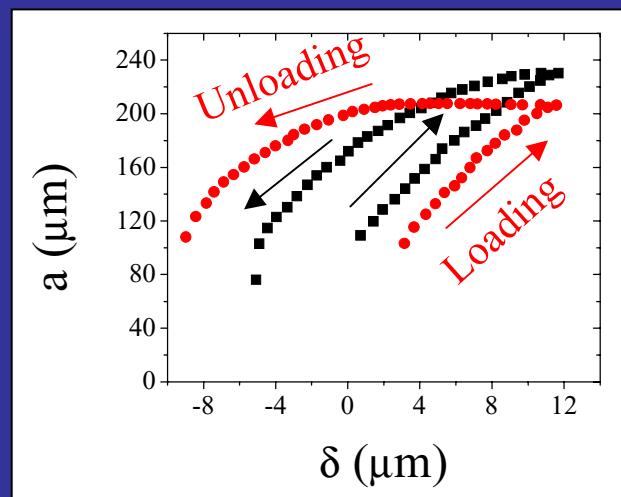
$v = 0.1 \mu\text{m/s}$



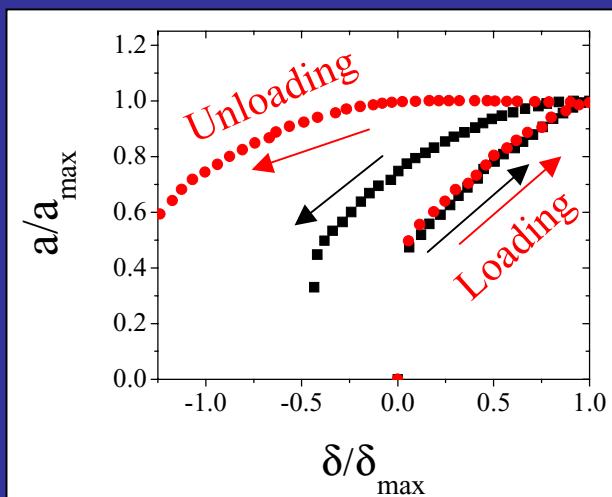
• PDMS macrolens

• as-is glass slide (black)
• UV-cleaned glass slide (red)

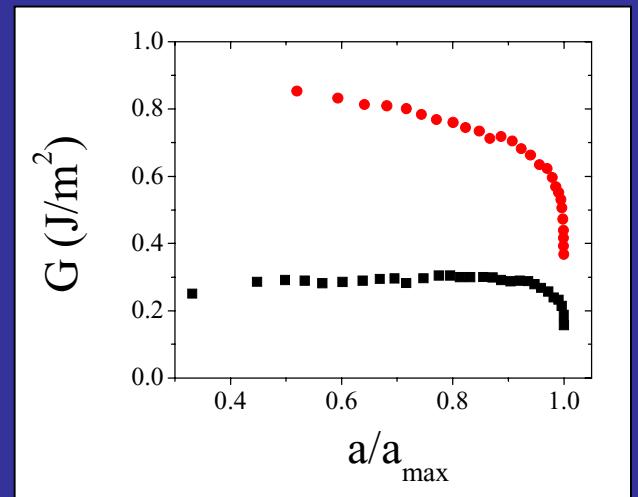
Raw Data



Normalized



Adhesion Energy

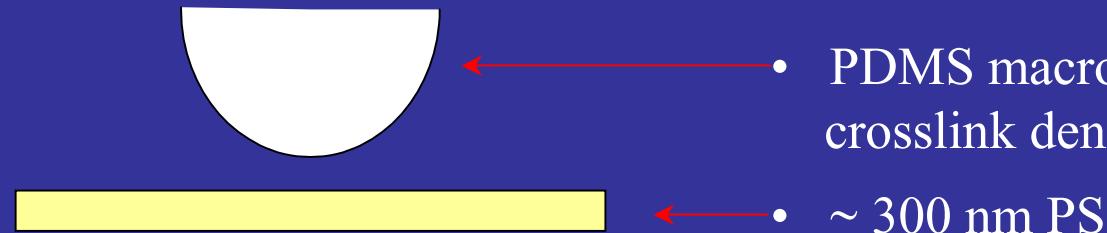




PS/PDMS Macrolens

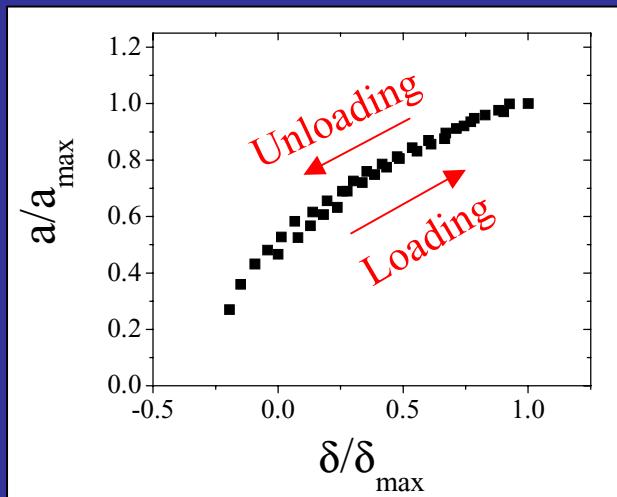
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$v = 0.1 \mu\text{m/s}$

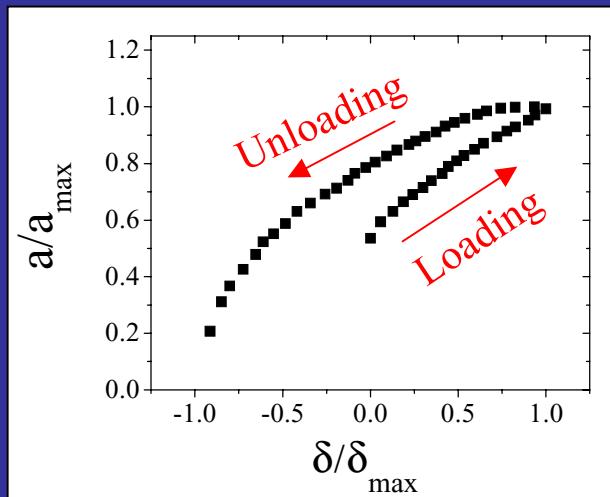


vary resin to catalyst

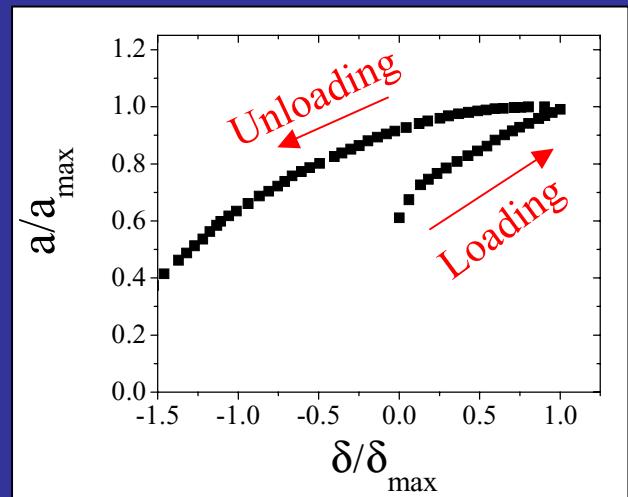
10:1 PDMS



20:1 PDMS



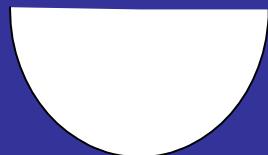
30:1 PDMS





Latex/PDMS

$v = 0.1 \mu\text{m/s}$

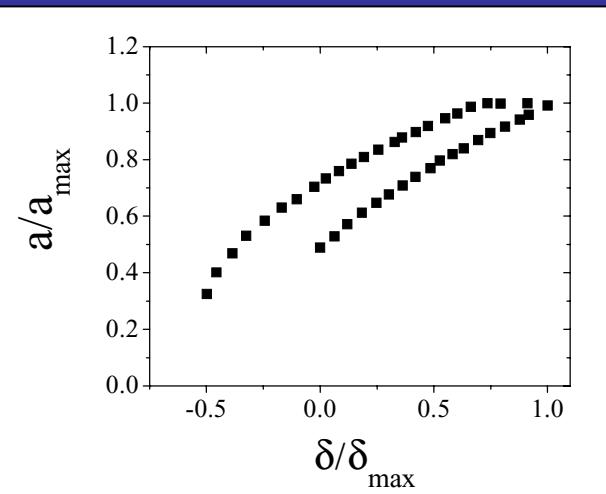


• PDMS macrolens

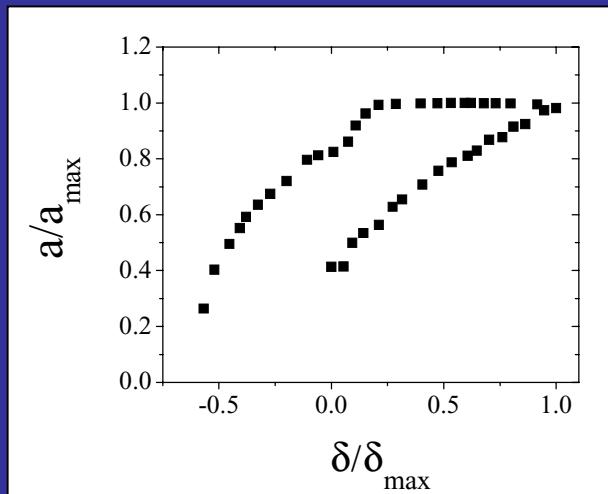


• Latex w/ varying composition
of components A & B

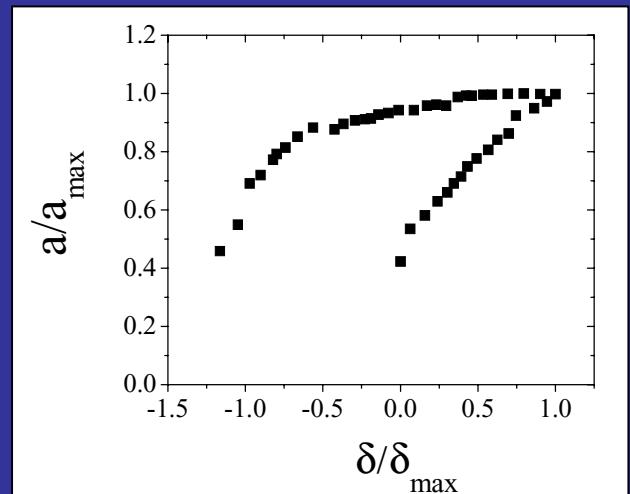
60% B



80% B



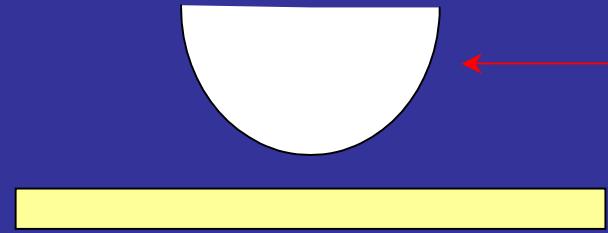
100% B





Epoxy/PDMS

$v = 0.1 \mu\text{m/s}$



• PDMS macrolens

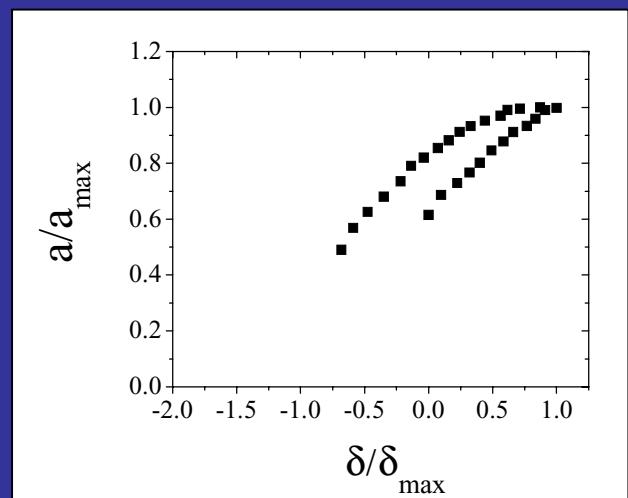
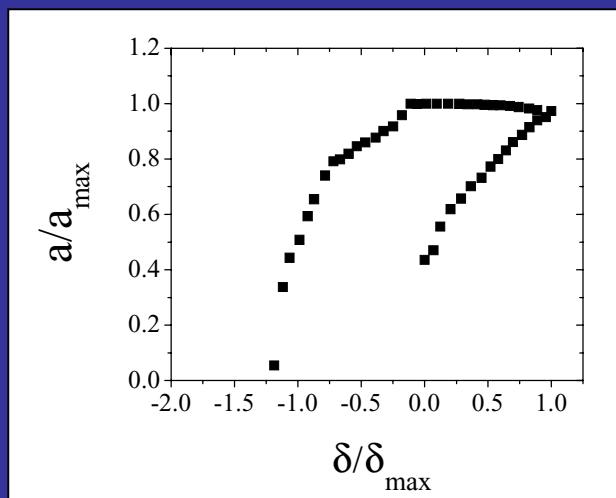
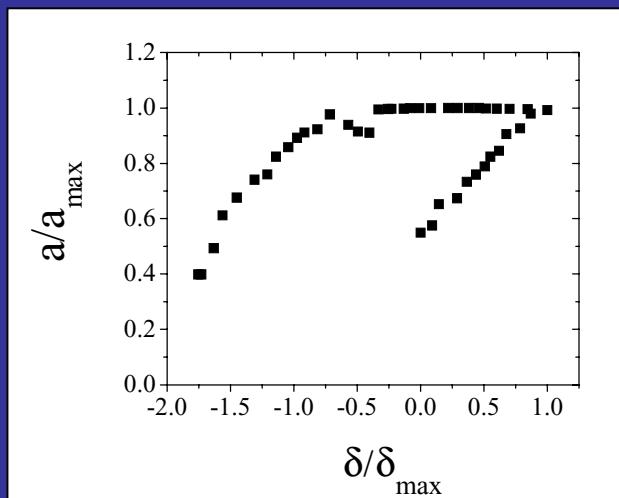
• Epoxy with varying curing history

➤ See Poster #11 (D. Raghavan, N. Eidelman)

25 °C

45 °C

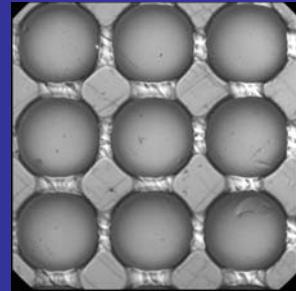
75 °C





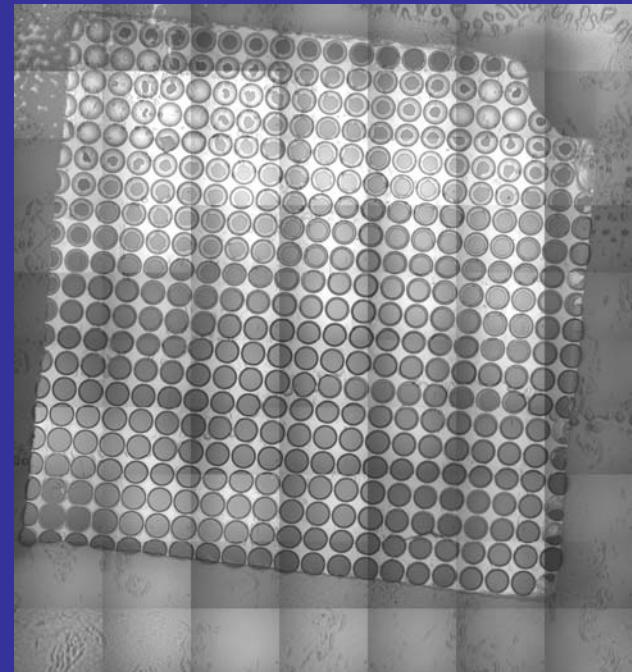
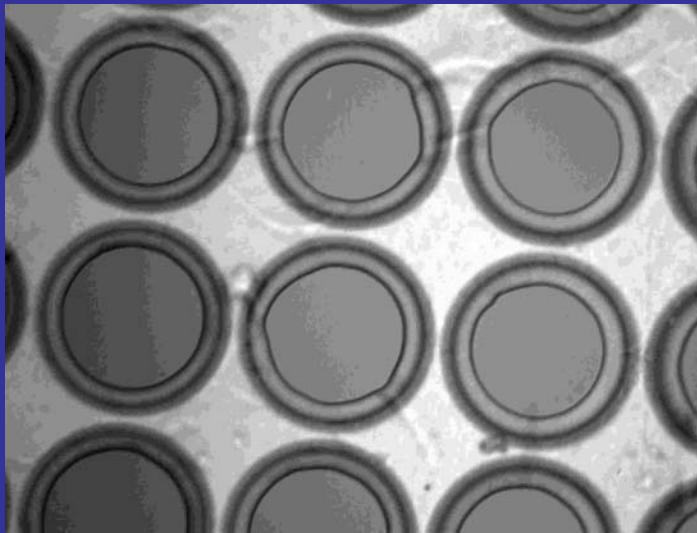
Multilens Array Image Capture

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Composite Image

Movie (real time)



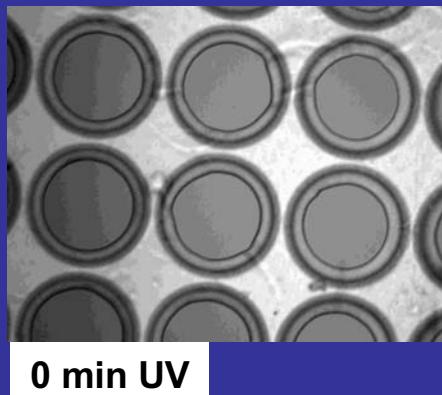


PSA/Epoxy Microlens

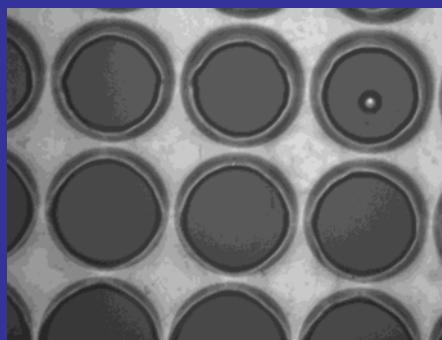
NIST
National Institute of
Standards and Technology

C. Stafford
A. Forster

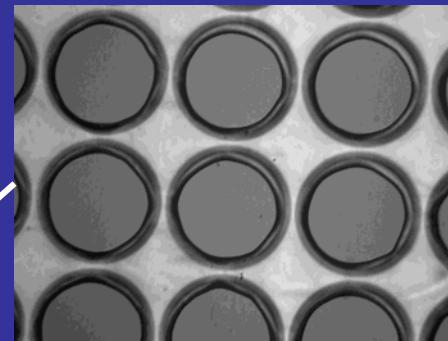
$v = 0.5 \mu\text{m/s}$



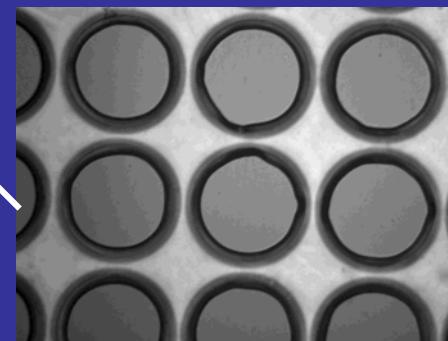
0 min UV



2 min UV



5 min UV

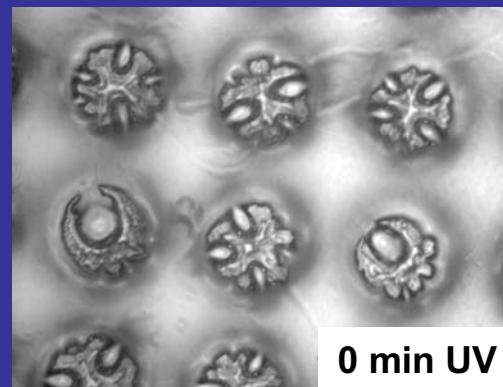
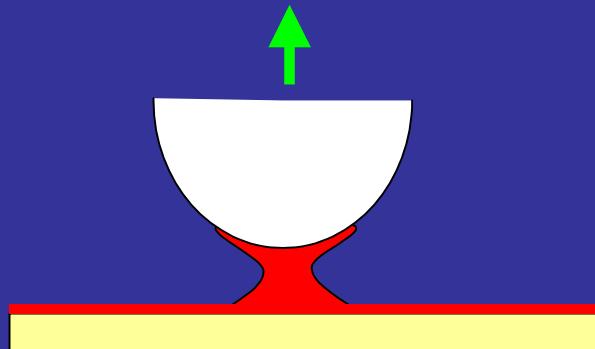


10 min UV

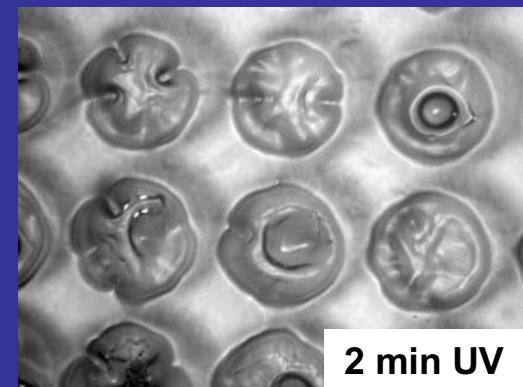


PSA/Epoxy Microlens

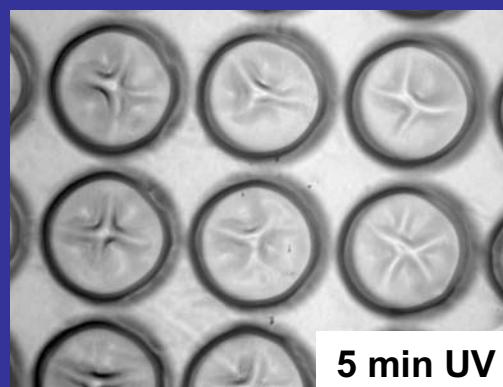
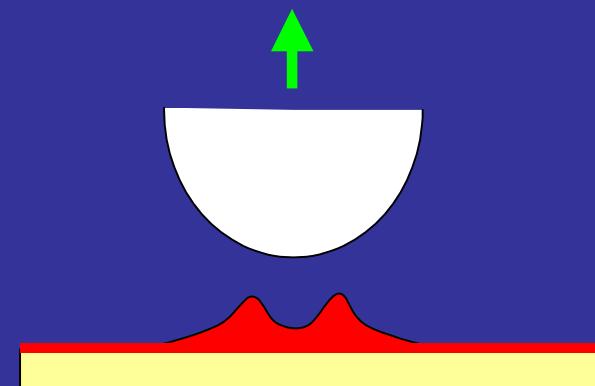
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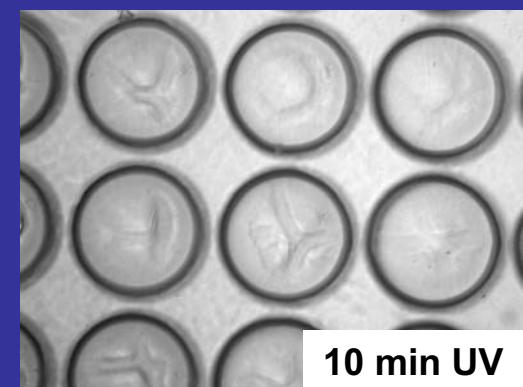
0 min UV



2 min UV



5 min UV



10 min UV

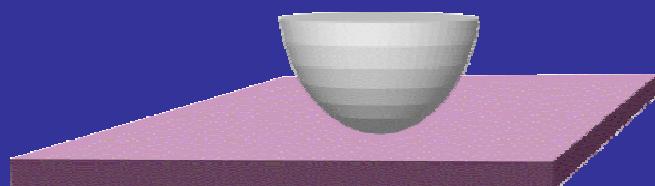
Irreversible Viscoelastic Deformation



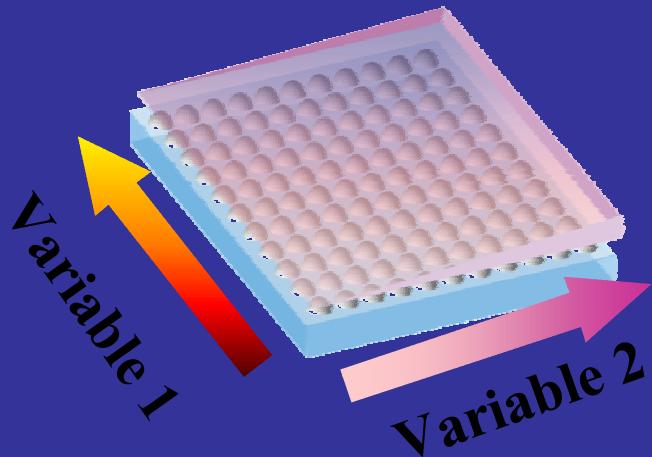
Overview of Capabilities

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Macrolens



Microlens Array



Lenses can be fabricated out of:

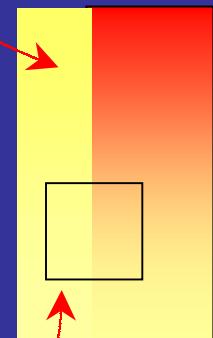
- glass • coated
- PDMS • adhesive
- epoxy

Substrate characteristics:

- coating • roughness
- metal • surface energy

microlens

internal
calibration





Future Directions



- Continue to develop instrumentation:
 - Tip/tilt
 - Temperature gradient stage
 - Sample positioning capability
- Continue to develop software analysis tools:
 - IDL
 - Image-Pro
 - Informatics
- Move into metal/polymer adhesion in conjunction with Combinatorial Peel Test (R. Song)
- Develop model PSA system to showcase capabilities across Adhesion & Mechanical Properties.
- Move into weak adhesion.



Open for Discussion



Next area of impact?